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DIVERGING LABOUR-MARKET TRAJECTORIES OF AUSTRALIAN GRADUATES FROM ADVANTAGED AND DISADVANTAGED SOCIAL BACKGROUNDS: A LONGITUDINAL ANALYSIS OF POPULATION-WIDE LINKED ADMINISTRATIVE DATA

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NON-TECHNICAL SUMMARY

Despite evidence that university participation enhances labour-market prospects, there are growing concerns about unequal returns to university for graduates from advantaged and disadvantaged social backgrounds. In this study, we overcome the methodological limitations plaguing earlier studies by leveraging large-scale linked administrative data covering the full population of individuals graduating from Australian universities over the 2005-2011 period. Capitalising on this unique and powerful data, we examine differences in the labour-market trajectories of graduates from multiple social backgrounds. We track both their employment earnings and the amount of unemployment benefits that they received. Our findings reveal higher returns to university education over the first 10 years post-graduation amongst graduates from advantaged social backgrounds compared to their peers from more disadvantaged backgrounds. However, there was substantial heterogeneity in graduates' earnings and unemployment-benefit receipt both across groups and over time. Compared to their advantaged counterparts, graduates with a disability and from non-English speaking backgrounds experienced the worst outcomes, whereas graduates from low socio-economic status backgrounds and regional, rural and remote areas fared comparatively well. Indigenous graduates experienced inconsistent outcomes that changed markedly with time since graduation.

These findings bear important implications for policy and practice. First, they demonstrate that inequalities observed at the access and participation stages of the student life cycle extend well beyond university graduation, underscoring the need for urgent policy attention on that phase. Second, they reveal significant heterogeneity in the extent to which graduates from different disadvantaged groups experience difficulties in the labour market—indicating that focused policy approaches and targeted support that recognise different experiences across groups are preferable over more general, 'broad-brush' approaches. Finally, they reveal considerable reliance on unemployment benefits across graduates from different socially disadvantaged groups—highlighting the importance of building up employability skills for these graduates as part of their university experience. At a broader level, our study serves to showcase the power of leveraging novel data sources (in our case, linked administrative datasets) and deep cross-sectoral partnerships (in our case, Government/Academia) to improve the stock of evidence-based knowledge on the intersections between social background and education.

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ABSTRACT

Despite mounting evidence that university participation enhances labour-market prospects, there are growing concerns about unequal returns to university for graduates from advantaged and disadvantaged social backgrounds. The available evidence-base, however, suffers from significant shortcomings that challenge the validity of these findings—including small sample sizes, cross-sectional designs, and self-reported measures of labour-market performance. In this study, we overcome these methodological limitations by leveraging large-scale linked administrative data covering the full population of individuals graduating from Australian universities over the 2005-2011 period (n=3,107,085 annual observations and 565,318 graduates). Capitalising on this unique and powerful dataset, we examine differences in the labour-market trajectories of graduates from multiple social backgrounds (based on socio-economic status, ethnicity, migration, location, and disability) over a 10-year observation window. We track both their employment earnings and the amount of unemployment benefits that they received. Our findings reveal higher returns to university education over the first 10 years post-graduation amongst graduates from advantaged social backgrounds compared to their peers from more disadvantaged social backgrounds. However, there was substantial heterogeneity in graduates' earnings and unemployment-benefit receipt both across groups and over time. Of the five groups considered, graduates with a disability and from non-English speaking backgrounds experienced the worst outcomes, whereas graduates from low socio-economic status backgrounds and regional, rural and remote areas fared comparatively well. Indigenous graduates experienced inconsistent outcomes that changed markedly with time since graduation. These findings bear important implications for policy and practice in relation to both higher education and the labour market.

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1. Introduction

University-level education has a range of positive impacts on individuals over the life course, including enhancing their labour-market prospects (e.g., Desjardins & Lee, 2016; Heckman, Humphries, & Veramendi, 2016; Henseke, 2019). However, there are increasing concerns about unequal returns to education amongst university graduates. Specifically, recent studies point to gaps in post-graduation outcomes between individuals from advantaged and disadvantaged social backgrounds—including by socio-economic background, ethnic origins, and disability status (e.g., Richardson, Bennett, & Roberts, 2016; Triventi, 2013), although with some evidence that these gaps may fade over time (Jacob, Klein, & Iannelli, 2015; Tomaszewski, Perales, Xiang, & Kubler, 2021). Differential or delayed returns to university education amongst graduates from traditionally disadvantaged social backgrounds represent a loss of productivity, a threat to social equity, and a policy challenge.

These differences in outcomes must be understood in the context of broader inequalities at various stages of the student life cycle, including higher-education access, participation, and success (Bennett et al., 2015). Traditionally, higher-education equity policies have pursued a 'widening participation' agenda—that is, they have focused on promoting equal access to university by students from different social backgrounds. More recently, there has been a growing emphasis on the importance of monitoring outcomes at later stages of the student life cycle, including course completion and post-graduation labour-market performance (Bennett et al., 2015; Pitman, Roberts, Bennett, & Richardson, 2019). Widening participation policies have been successful in countries such as Australia (where this study is conducted), resulting in greater inflows of students from disadvantaged social backgrounds into higher-education institutions. However, the growing representation of students from disadvantaged social backgrounds at university has simultaneously led to concerns about inadequate support during the participation stage, resulting in increased drop-out rates and poorer graduate outcomes (Harvey, Burnheim, & Brett, 2016; Pitman et al., 2019; Productivity Commission, 2019).

Within this context, research that focuses on charting the post-graduation outcomes of individuals from advantaged and disadvantaged population groups is sorely needed. Further, existing studies suffer from significant shortcomings that challenge the internal and external validity of their findings. As discussed below, these shortcomings include small sample sizes, cross-sectional designs, and self-reported outcome measures. Capitalising on unique and powerful linked administrative data from Australia, the analyses presented in this paper overcome each of those limitations. In doing so, they provide

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distinctively robust evidence on similarities and differences in the post-graduation outcome trajectories of individuals from advantaged and disadvantaged social backgrounds.

2. Literature review

2.1 Conceptual framework

Higher education increases labour-market performance through a range of well-established channels. For example, higher-education participation leads to human-capital accumulation via the development of cognitive and non-cognitive skills (Heckman et al., 2016), whereas higher-education credentials signal high levels of productivity to prospective employers (Gibson, 2000; Jacob et al., 2015; Aina & Pastore, 2020). Both of these pathways should in turn enhance employment prospects and outcomes amongst university graduates compared to other individuals. Yet several factors at the individual and family level may interfere with how these processes unfold for graduates from advantaged and disadvantaged social backgrounds, resulting in differential returns to university education.

Graduates from disadvantaged social groups—for example, those from a low socio-economic status (SES) background or certain ethnic minorities—may have lower social and cultural capital (Burke, Scurry, & Blenkinsopp, 2020; Coleman, 1988; Franzen & Hangartner, 2006; Lin, 2001), and/or less extensive social networks that can be used to secure 'good' jobs (Friedman & Laurison, 2019; Lin, 1999; Manroop & Richardson, 2016). They may also be subjected to implicit and/or explicit discrimination by employers (e.g., Quadlin, 2018; Rivera, 2020). Collectively, these circumstances may result in diminished chances for graduates from disadvantaged social backgrounds to leverage their educational credentials to access good jobs, negotiate high starting wages, and achieve upwards career mobility (Tomaszewski et al., 2021; Witteveen & Attewell, 2020).

These arguments are consistent with tenets of the reproduction thesis of intergenerational advantage, which poses that the association between individuals' social origins and destinations remains strong despite continuing higher-education expansion (Witteveen & Attewell, 2020). They are also in consonance with life-course theory—which highlights the importance of inter-relationships between life domains in structuring individuals' life outcomes (Elder, Johnson, & Crosnoe, 2003)—and cumulative-disadvantage theory—which posits that early exposures to disadvantage increase the likelihood of experiencing future disadvantage (e.g. DiPrete & Eirich, 2006). Collectively, these perspectives underscore the importance of paying attention to social hierarchies between status groups

and the social locations occupied by university graduates in explaining heterogeneity in the returns to tertiary education.

The processes described here can be used to explain empirical disparities in labour-market outcomes amongst university graduates from advantaged and disadvantaged social backgrounds in the Australian context, including differences in employment rates, occupational attainment and earnings by socio-economic, ethnic and language background, disability status, and area remoteness (Grusky, 2019; Harvey et al. 2016). In the next section, we summarise empirical evidence on differences in the post-graduation labour-market outcomes from members of advantaged and disadvantaged groups, with a focus on the Australian context.

2.2 Empirical findings from international studies

A sizeable body of empirical research has examined the returns to higher education by comparing the outcomes of individuals with and without university qualifications (e.g., Corliss, Daly, & Lewis, 2020; Daly, Lewis, Corliss, & Heaslip, 2015; Desjardins & Lee, 2016; Heckman et al., 2016; Van der Velden & Wolbers, 2006). Research focusing on heterogeneity in outcomes amongst different groups *within* the graduate population is however more limited. Consistent with the theoretical considerations outlined in the previous section, empirical studies have generally found that the labour-market performance of graduates from social groups that experience broader disadvantage in society is lower than that of graduates from other groups (Friedman & Laurison, 2019).

Concerning socio-economic background, Witteveen and Attewell (2017) used US longitudinal survey data to unveil substantial income gaps between graduates from different socio-economic backgrounds at four and 10 years after college completion. Similarly, Manzoni and Streib (2018) documented substantial wage gaps 10 years post-graduation between US graduates who were the first in their family to complete a college degree and those who were not. In both studies, occupational and industrial sorting was largely responsible for these disparities. Other studies have compared graduates from minority and majority ethnic backgrounds. For instance, Rafferty (2012) utilised UK survey data to explore 'ethnic penalties' amongst university graduates. The findings indicated that graduates from certain minority ethnic groups (e.g., Black African and Black Caribbean) were significantly more likely to be over-educated and under-employed, and earned significantly less than comparable white, UK-born graduates. Similarly, drawing on administrative data collected by UK universities upon enrolment and surveys conducted six months after graduation, Zwysen and Longhi (2018) found that graduates from

minority ethnic groups were less likely to be employed than their white, UK-born peers, although they found no evidence of wage gaps amongst those who were employed. Another body of research has focused on graduates with disability, and found them to be disadvantaged in terms of their labour-market outcomes (Huber, Oswald, Webb, & Avila-John, 2016; Zarifa, Walters, & Seward, 2015). For example, analyses of Canadian survey data revealed that graduates with a disability were not only less likely to be employed full-time, but also received lower average earnings when employed, compared with graduates without disabilities (Zarifa et al., 2015).

Despite the existence of these pioneer empirical studies, as we demonstrate over the next sections, the available evidence is neither encompassing nor readily applicable to Australia.

2.3 The Australian context and evidence

In addition to the important methodological advances outlined in the next section, we contribute to the field by studying post-graduation outcomes in the Australian context. Australia represents an institutional environment that has received less attention than that in the UK or the US, and an interesting case study to interrogate these issues.

Between 1989 and 2014, the rate of higher-education attainment in the Australian population aged 25-34 years increased from 12% to 37% (Department of Education and Training, 2015). The expansion of the Australian higher-education sector reflected the Government's policy focus on increasing participation to shape a competitive workforce in the global economy (Bradley, Noonan, Nugent, & Scales, 2008). In parallel, successive Australian governments since the 1960s developed an interest in equity in higher education, based on the premise that the underrepresentation of certain groups represents underutilised talent (National Board of Employment Education and Training (NBEET), 1996). These developments led to the designation of five population-based groups as the focus of the Government's equity in higher-education agenda: individuals from low-SES backgrounds, Non English Speaking Backgrounds (NESB) individuals, residents of regional/remote areas, Indigenous people, and individuals with a disability.[1] As described below, while some progress towards the equity agenda has been achieved, these five groups have continued to experience considerable disadvantage at all stages

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[1] In addition, women participating in non-traditional fields of study (e.g., Engineering, Law and Information Technology) are also designated as a group of focus for contemporary equity policies.

of the student life cycle (Productivity Commission, 2019), particularly those who are members of multiple disadvantaged groups (Devlin & McKay, 2017; Harvey et al., 2016).

There are also significant peculiarities of the Australian labour market that are important in contextualising the outcomes of graduates from advantaged and disadvantaged social backgrounds alike. Internationally, Australia is considered a country with a high standard of living and strong growth, as indicated by markers such as GDP per capita (OECD, 2021b). At the same time, Australia exhibits lower levels of income inequalities than other highly developed countries, such as the US (OECD, 2021c). This is partially due to a strong labour market, with a relatively low unemployment rate (5.2% in 2019; OECD, 2021d). Another relevant statistic pertains to the high educational attainment in the country, with 47.1% of the general population aged 25-64 having a university degree, compared to an average of 38% in OECD countries in 2019 (OECD, 2021a). The value of higher education for individuals is illustrated by differences in median lifetime income between those with a university degree and those with secondary-education, estimated at A$1,116,000 for men and A$800,000 for women (Norton, 2012).

Taken together, these factors indicate that the Australian higher-education system and labour market for university graduates is distinct from that in other developed countries. This suggests that differences in the post-graduation outcomes of students from advantaged and disadvantaged social backgrounds may play out differently than in other institutional contexts. Due to the relatively low levels of income inequality and high value of university degrees, we expect differences in labour-market outcomes between advantaged and disadvantaged university graduates in Australia to be comparatively low by international standards. However, surprisingly little Australian research has investigated differences in graduate outcomes across social groups (Whitney & Purchase, 2018).

Most existing Australian studies have focused on graduates from low-SES backgrounds, operationalised using area-based indicators of disadvantage, or parental occupation. Their results indicate that, in the first few years after graduation, low-SES graduates are less likely to be employed (Richardson et al., 2016) and receive lower earnings (Pitman et al., 2019) than high-SES graduates. However, two Australian studies that tracked graduate outcomes over a longer time frame found that these initial gaps faded over time (Edwards & Coates, 2011; Tomaszewski et al., 2021).

There is limited Australian empirical scholarship focusing on other disadvantaged social groups. The few studies that have examined disparities by area remoteness have not delivered conclusive evidence, with

regional/rural graduates having a similar probability of being employed as metropolitan graduates (Li, Mahuteau, Dockery, & Junankar, 2017) although earning less (Pitman et al., 2019). There are also inconsistent findings concerning graduates' ethnicity. For instance, Pitman et al. (2017) reported that Australian Indigenous graduates earned more than non-Indigenous graduates, while Coates and Edwards (2009) found a slightly lower rate of full-time employment amongst Indigenous than non-Indigenous graduates one year after graduation, although this reversed five years after graduation. The evidence is also mixed for NESB graduates, with some studies reporting a higher likelihood of employment and higher earnings for this group (Pitman et al., 2019) and others reporting greater levels of job-skill mismatch and lower earnings (Li et al., 2017). Empirical studies also point to lower full-time employment rates among NESB graduates post-graduation, with some evidence of a subsequent 'catch-up' effect (Coates & Edwards, 2009).

The Australian evidence is most conclusive for graduates with a disability, who are reported to be markedly disadvantaged in terms of their post-university outcomes relative to graduates without a disability—denoted by a lower likelihood of employment and lower earnings (Richardson et al., 2016). Furthermore, a study tracking longer-term post-graduation outcomes reported that the 'gaps' in full-time employment between graduates with and without a disability increased over time (Coates & Edwards, 2009).

Despite emerging concerns about the labour-market outcomes of graduates who belong to more than one disadvantaged social group (Harvey et al., 2016), there is a paucity of empirical evidence in this space. Existing studies of cumulative disadvantage have instead focused on higher-education participation and attainment, with their findings indicating that membership in multiple disadvantaged social groups is associated with more pronounced difficulties accessing and graduating from university (see e.g., Shalley et al., 2019).

In the next section, we outline the methodological contributions that we make to the existing Australian and international literature.

3. The present study: Gaps in knowledge and research aims

As noted in the previous section, few studies have provided robust and comprehensive evidence on differences in graduate outcomes across social groups. The bulk of these studies has been conducted in the US and Western Europe, with Australian evidence being very limited and largely inconclusive.

Further, as we will discuss in this section, current understandings of the field remain blurred by data-driven methodological limitations in existing scholarship. In this study, we are able to address a number of these issues through innovative use of administrative data covering a full population of domestic undergraduate students graduating from Australian universities between 2005 and 2011. Specifically, we leverage a unique dataset comprising integrated administrative records linked across several Australian Government agencies including student information from the higher-education system, personal income tax records, and social-service delivery data on welfare payments. In the remainder of this section, we outline the benefits of the data and approach pursed in the present study against the backdrop of the limitations of existing research in this area.

First, a majority of existing studies comparing the post-graduation outcomes of individuals from different social groups have utilised self-reported measures of labour-market outcomes contained in social surveys. Yet survey measures of key markers of labour-market success, such as income and earnings, are prone to measurement error (e.g., due to recall issues) and report bias (e.g., due to individuals providing socially desirable responses) (Krumpal, 2013). These measures are also subject to disproportionately high rates of non-random missing data, with a large share of responses in major social surveys being fully or partially imputed. For example, up to 15% of the personal labour income responses and 29% of the household income responses were subject to imputation in the Australian flagship household panel, the Household, Income and Labour Dynamics in Australia Survey (HILDA) (Frick & Grabka, 2010). In contrast, the linked administrative dataset leveraged by the present study provides access to personal income information captured from individuals' tax records that are precise, reliable and incur virtually no missing data.

Second, most studies of graduate labour-market outcomes have relied on employment and income as the core indicators of graduate performance. While these are unambiguously important markers of success for individual graduates, we posit that income-support receipt is a key additional measure to consider, one that encompasses the benefits of higher education from the perspective of government and official institutions (NBEET, 1996). An important rationale for widening participation in higher education for socially and/or economically disadvantaged groups lies in disrupting processes of intergenerational welfare dependency through providing equal opportunities for education participation (NBEET, 1996; Perales et al., 2014). As such, it is important to gauge the extent to which obtaining a university degree helps graduates avoid relying on income support after graduation. Welfare receipt is an important construct used to measure disadvantage across a number of literatures (see e.g.,

Cobb-Clark, 2019; Perales et al., 2014). Yet, to our knowledge, no studies in this field have compared the amount of income support received by graduates from different population groups. The unique linked administrative data leveraged in this study allows us to undertake these comparisons, and to do so using an objective and error-free measure of welfare receipt obtained from official government records.

Third, survey-based studies comparing the labour-market outcomes of graduates from advantaged and disadvantaged social backgrounds often rely on small sample sizes for key subgroups. This occurs because some disadvantaged groups are also minorities (e.g., Indigenous Australians comprise less than 3% of the Australian population, ABS, 2017), or represent a small share of students (e.g., individuals with a recognised disability account for about 7% of university students in Australia (Department of Education Skills and Employment, 2020). As a result, the analyses in many existing studies may be under-powered, inflating standard errors and enhancing the risk of Type-II estimation errors (i.e., failing to observe a relationship in the sample that exists in the population). In contrast, the linked administrative dataset leveraged in this study allows us to observe the outcomes of the *full population* of domestic university students in Australia graduating over the 2005-2011 period, maximising the external validity of the findings and minimising estimation errors. As a point of illustration, using a large household panel survey of over 20,000 respondents (HILDA), Tomaszewski et al. (2019) observed the post-graduation outcomes of 18 Indigenous individuals and 42 individuals with a disability. In the linked administrative data utilised in the present study, we are able to track the outcomes of 7,011 Indigenous graduates and 25,986 graduates with a disability.

Fourth, most studies in this space have used data from a single time point. Reliance on cross-sectional rather than longitudinal data is problematic in several ways. One issue is that cross-sectional models are less able than longitudinal models to account for unobserved sources of confounding, making the results more vulnerable to omitted-variable bias (Singer & Willett, 2003). Perhaps more importantly, single-point datasets prevent more nuanced and insightful analyses of post-graduation *trajectories* in outcomes. The latter provide additional and important information about whether or not any differences in the returns to university education between social groups fade or intensify over time, and the specific timing of any changes (Tomaszewski et al., 2021). The linked administrative data used in this study allow us to observe individual graduates for up to six years and to track outcomes across different cohorts of graduates up to 10 years post-university. This enables us to identify temporal dynamics in the relationships of interest. This approach may help reconcile the seemingly contradictory findings

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from previous research discussed above, which may stem from studies measuring graduate outcomes at different numbers of years since graduation.

Fifth, studies in the field have largely restricted their focus to comparisons between individuals who belong to a single disadvantaged group and individuals who do not belong to such group, all else being equal. As such, these studies have largely neglected the fact that some graduates belong to more than one disadvantaged group; in other words, some graduates experience multiple or cumulative disadvantage (Harvey et al., 2016). In this study, we explicitly consider the accumulation of disadvantage. This is again made possible by the large sample sizes afforded by the administrative data at hand, which allow us to observe large numbers of graduates who simultaneously hold two or three or more markers of disadvantage.

In the next section, we describe the data and methods used in our empirical analyses.

4. Methodology

4.1 Dataset and sample selection

We utilise a customised Multi-Agency Data Integration Project (MADIP) dataset made available to the research team by the Australian Government Department of Education, Skill and Employment. The dataset comprises records extracted from the Higher Education Information Management System (HEIMS) linked to information sourced from Personal Income Tax (PIT) data and Social Security and Related Information (SSRI) data. The Australian Bureau of Statistics (ABS) is responsible for linking the information across these datasets, providing a high linkage rate (95% of all graduates), and facilitates access to linked de-identified unit level records. More detailed information about the standard MADIP dataset, including the linkage methodology, is available elsewhere (ABS, 2018).

The HEIMS dataset constitutes the cornerstone of the linked dataset and contains higher-education records of all domestic undergraduate students who graduated from an Australian higher education institution between 2005 and 2011.[2] Amongst others, the data include information on the timing of enrolment in a higher-education institution, type of course attended, field of study and completion date,

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[2] This includes Public Universities, Private Universities and accredited Non-University Higher Education Institutions.

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as well as students' characteristics such as age, gender, country of birth, language spoken at home and disability. The PIT and SSRI datasets add rich and accurate information on labour-market outcomes, including different types of income (PIT) and income-support payments (SSRI).

The available PIT and SSRI data cover six financial (tax) years between 2010/11 and 2015/16 and we start tracking labour-market outcomes from the first *full* financial year as a graduate.[3] This means that, for the most recent cohort of HEIMS graduates (i.e., those completing their degrees in 2011), we observe labour-market outcomes in the first four financial years after graduation. Meanwhile, for the oldest cohort of graduates (i.e., those finishing in 2011), we observe labour-market outcomes five to ten years after graduation. For more detailed information on the years captured for each cohort, see Figure A1 in the Appendix.

The data drawn from HEIMS comprised 3,107,085 annual observations from 565,318 graduates. About 3% of person-year observations had missing data on the analytic variables and were excluded from analysis. The final analytical sample consists of 3,015,028 observations from 563,391 graduates, with individuals tracked for 5.53 years on average.

4.2 Employment income and unemployment benefits

Our primary outcome variables are two measures of employment income and unemployment payments. The *employment income* variable was obtained from individual tax records (PIT data) and captures any income received as an employee or for any service rendered over a calendar year.[4] The *unemployment benefit* variable was obtained from income-support records (SSRI data) and captures the sum of unemployment payments received by an individual in a given financial year.[5] Both outcome variables are adjusted for inflation and expressed in AUD$2016. As shown in Table 1, the average

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[3] In Australia, a financial (tax) year begins on 1 July each calendar year, and runs until 30 June the following calendar year, while the academic year starts in January and ends in December. As a result, most students finish education in the middle of the financial year.

[4] As a sensitivity analysis, we tested models of (i) gross income and (ii) the sum of income from personal exertion and business income. The results were very similar.

[5] The specific payments covered by this measure are Newstart Allowance and Youth Allowance (Other), the two primary out-of-work benefits in Australia. For further information on Australian income-support payments, see Australian Government (2020).

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employment income in the pooled sample is A$61,543 (SD=A$41,081), whereas average unemployment benefits received amount to A$260 (SD=A$1,706).

4.3 Social background

Our key explanatory variables identify graduates from disadvantaged social backgrounds that approximate five of the officially designated equity groups in the Australian higher-education system. We construct these variables approximating the official definitions used by the Australian Government as closely as possible.

Low socio-economic status (Low SES) graduates are those who in the year before commencing university lived in the 20% of areas with the lowest values in the Socio-Economic Index for Areas (SEIFA) Index of Education and Occupation.[6] *Regional/rural/remote (RRR) graduates* are those who in the year before commencing university lived in areas other than major cities, based on the Australian Bureau of Statistics' Remoteness Areas. *NESB graduates* are foreign-born individuals who, at enrolment or some other point during their studies, reported coming from a household in which a language other than English was spoken. *Graduates with a disability* are individuals who, at enrolment or some other point during their studies, self-reported having a disability. Finally, *Indigenous graduates* are those who reported being of Aboriginal and/or Torres Strait Islander descent in their interactions with the Australian Government.[7] Pooling all observations in our dataset, we observe that 22.2% of graduates qualify as RRR, 12.0% as Low SES, 8.4% as NESB, 4.6% as having a disability, and 1.2% as Indigenous (Table 1).

We also run additional analyses using a measure of *cumulative disadvantage*. This took the form of a categorical variable capturing the number of the above groups to which an individual belongs. The categories are '0 groups' (60.5% of the person-year observations), '1 group' (31.2%), '2 groups' (7.7%), and '3 or more groups' (0.6%).

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[6] These data come from MADIP address histories compiled from multiple sources, including individuals' interactions with the Australian public service, Medicare and welfare system, as well as from Census records.

[7] The variable is based on a flag that uses any available dataset across MADIP to check whether an individual *ever* identified themselves as being Indigenous.

4.4 Control variables

In our models, we control for a set of variables that may confound the relationships between disadvantaged social background and post-graduation labour-market outcomes. The control variables include several time-invariant variables, such as gender (female; male), field of study (26 categories), a dummy variable identifying graduates who completed dual/multiple degrees (yes; no), and a categorical variable denoting the number of years since graduation (2005 to 2011). We further include four time-varying control variables: age (seven age brackets), state of residence (a set of 8 dummy variables), receiving business income (yes; no), and being currently enrolled in further education (yes; no). The indicator variable capturing receiving business income is included in the models to control for the fact that people running a business are less likely to have employment income. Being enrolled in further study is included amongst the controls to account for the fact that graduates who do so might not yet fully participate in the labour market.[8] Table 1 presents descriptive statistics for all analytic variables.

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[8] As a sensitivity analysis, we also estimated models that excluded all observations where individuals were enrolled in further study. The overall conclusions remained the same.

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Table 1. Mean and standard deviations for analytic variables

	Mean/ % (Standard deviation)
<u>Outcomes</u>	
Income from personal exertion (A$)	61,543 (41,081)
Total unemployment payments (A$)	260 (1,706)
<u>Key predictors</u>	
Disadvantaged social backgrounds (%)	
Low SES	12.0
Disability	4.6
NESB	8.4
RRR	22.2
Indigenous	1.2
Cumulative disadvantage (%)	
0 groups	60.5
1 group	31.2
2 groups	7.7
3+ groups	0.6
<u>Controls</u>	
Gender (%)	
Female	61.5
Male	38.5
Age group (%)	
<=25 years	14.0
26-30 years	48.6
31-35 years	21.0
36-40 years	5.8
41-45 years	3.9
46-50 years	2.8
51+ years	4.0
Study area (%)	
Agriculture	0.6
Architecture and urban environment	1.1
Building	0.6
Communications	4.0
Dental studies	0.4
Education	12.4
Engineering and related technologies	5.8
English language	0.4
Environmental studies	1.2
Humanities (inc. history, geography & languages)	2.9
Information technology	3.2
Management and commerce	19.2
Mathematics	0.3
Medical	2.1
Medical science	0.9
Nursing	7.9
Other creative	5.0
Other health	7.8
Other science	6.7
Political science	0.4

Psychology	2.9
Society and culture - economics	0.9
Society and culture - law	3.7
Social work	2.1
Society and culture (other)	7.4
Veterinary science	0.3
Dual/multiple degrees (%)	9.4
Graduation year (%)	
2005	11.7
2006	13.0
2007	15.4
2008	15.8
2009	16.8
2010	14.8
2011	12.5
State of residence (%)	
New South Wales	31.3
Victoria	27.6
Queensland	18.3
South Australia	6.8
Western Australia	10.1
Tasmania	1.8
Northern Territory	0.8
Australian Capital Territory	3.2
Other	< 0.1
Receives business income (%)	9.3
Is enrolled in further education (%)	13.6

Notes: Data from customised MADIP dataset (2011-2016). SES: Socio-economic status. NESB: Non English Speaking Background. RRR: Regional, rural or remote.

4.5 Analytic approach

To investigate differences in post-graduation trajectories between graduates from advantaged and disadvantaged social backgrounds, we fit a series of growth models of the following form:

$$O_{gt} = \alpha + \boldsymbol{\beta}_1 \boldsymbol{D}_g + \beta_2 Y_{gt} + \boldsymbol{\beta}_3 (\boldsymbol{D} \times \boldsymbol{Y})_{gt} + \boldsymbol{\beta}_4 \boldsymbol{C}_{gt} + u_g + e_{gt}$$

Where the *g* and *t* subscript denote graduates and time points, respectively; *O* is a continuous-type labour-market outcome (employment income or unemployment benefits); α is the model's grand intercept; *D* is a set of dummy variables capturing membership in a disadvantaged social group; *Y* is a categorical variable capturing the number of years since graduation (1 through to 10); *D×Y* is the focal interaction effect between the previous two variables; *C* is a set of control variables, as described before; β_1 to β_4 are coefficients (or vectors of coefficients) to be estimated; *u* is an individual-level random effect (or random intercept) capturing unobserved effects assumed to be normally distributed and orthogonal

to the model variables; and *e* is the usual individual-level regression error. In a second set of analogous models, we replace the dummy variables capturing membership in a disadvantaged social group (*D*) by the categorical cumulative disadvantage measure described before.

The key parameters of interest are the β_3 coefficients on the interaction effects, which indicate whether the post-graduation trajectories of graduates who belong to a disadvantaged social group differ from those of their more advantaged peers in the reference group. Our use of a categorical variable to capture time since graduation (i.e., 10 annual dummy variables) allows the post-graduation labour-market trajectories to take a fully flexible, non-parametric shape. This is preferable over imposing a uniform function (linear, quadratic, cubic) across all groups, as this may or may not reflect the true shape of the group trajectories. To ease the interpretation of the models, we present and discuss their results as average marginal effects (AMEs), holding the random effects at zero.

5. Results

5.1 Descriptive patterns

Table 2 compares the average employment income and unemployment benefits of individuals from advantaged and disadvantaged groups in the first, fifth, and tenth year after graduation, as well as for all years pooled together.

Graduates with a disability appear to be the most disadvantaged, earning A\$7,503 less than graduates without disability in the first year after graduation and A\$12,519 less ten years after. NESB graduates also earn less than other graduates in the first year after graduation, but this gap closes over time—from A\$3,597 to A\$942. In contrast, graduates from other disadvantaged social backgrounds (Low SES, RRR & Indigenous) earn more than their peers immediately after graduation, but this relationship reverses over time. For example, Indigenous graduates earn A\$3,129 more than non-Indigenous graduates on year after graduation, but A\$5,667 less ten years after.

Graduates from all disadvantaged groups receive on average higher unemployment benefits than the advantaged graduates at all times. The gap between disadvantaged and advantaged graduates closes over time for all groups but Indigenous graduates. The difference shrinks fastest in the case of NESB graduates. It drops from A\$318 in the first year to A\$68 in the fifth year and A\$54 in the tenth year. In contrast, the gap for the Indigenous graduates rises from A\$243 in the first year to A\$279 in the fifth and A\$348 in the tenth.

Table 2. Mean employment income and unemployment benefits, by student social-background characteristics and time since graduation

	Employment income (in A$)				Unemployment benefits (in A$)			
	All years pooled	1 year after	5 years after	10 years after	All years pooled	1 year after	5 years after	10 years after
Low SES	61,502	48,768	63,968	70,346	328	542	276	235
Not Low SES	61,548	47,533	64,273	72,283	250	367	223	190
Disability	51,885	40,549	54,612	60,040	543	737	479	360
No Disability	62,009	48,052	64,696	72,559	246	370	218	188
NESB	59,372	44,387	62,265	71,191	357	679	292	245
Not NESB	61,741	47,984	64,417	72,133	251	361	224	191
RRR	61,015	49,850	63,299	69,428	295	440	264	208
Not RRR	61,693	47,049	64,503	72,771	249	372	220	192
Indigenous	60,976	50,771	63,479	66,455	557	628	505	539
Not Indigenous	61,550	47,642	64,246	72,122	256	385	226	191
0 groups	62,493	47,725	65,289	73,761	215	303	195	171
1 group	60,149	47,374	62,758	69,480	308	483	265	225
2 groups	60,209	48,766	62,447	68,834	380	609	333	256
3+ groups	54,970	45,420	57,373	63,375	675	929	579	491

Notes: Data from customised MADIP dataset (2011-2016). SES: Socio-economic status. NESB: Non English Speaking Background. RRR: Regional, rural or remote.

5.2 Growth modelling

To verify our descriptive results, we turn to multivariable growth models that are adjusted for a range of potential confounders. The models incorporate an individual-level random intercept (to account for unobserved effects) and interaction terms between the disadvantaged social-background indicators and time since graduation (to capture longitudinal trends). Due to the complexity of these models, their results are best grasped when presented graphically. To this end, Figures 1 to 4 plot the key results from these analyses (i.e., differences between advantaged and disadvantaged groups of graduates over time). Full sets of model parameters are presented in Tables 1 and 2 in the Appendix.

Figure 1 presents the estimated outcome trajectories (based on predictive margins) for graduates from the five disadvantaged social backgrounds and those of their counterparts from advantaged backgrounds. Concerning income from employment (left panel), the picture is consistent for all groups of graduates: income increases at a faster pace during the initial few years post-graduation, tapering off towards the end of the observation period. There are, however, marked differences amongst graduates from different disadvantaged social backgrounds. Low SES graduates follow an almost identical trajectory as other graduates. Their adjusted average employment income grows linearly over time,

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from A\$48,291 in the first year, to A\$64,105 in the fifth year, and to A\$71,304 in the tenth year. Indigenous and RRR graduates initially earn slightly more than their respective counterparts. However, the relationship reverses four to six years after graduation. For NESB graduates and those with a disability, a gap appears early on and becomes visibly wider over time.

Concerning unemployment payments, we observe that these are highest in the early years after graduation and decrease over time (right panel). The pace of the decline is fastest over the first few years, and it reduces towards the end of the observation window. Graduates from all disadvantaged social backgrounds receive, on average, higher amounts of unemployment benefits than their peers. However, these differences vary markedly depending on the group. On the one hand, there is relatively little difference between RRR and Low SES graduates and their respective counterparts. In contrast, differences between Indigenous graduates and those with a disability and their comparison groups are much greater. NESB graduates start with the highest gap, but this declines rapidly between the second and fifth year, and remains stable thereafter.

Figure 2 extends these analyses by directly focusing on the gap (differential) between the advantaged and disadvantaged graduates and how it changes over time. This is accomplished by plotting the marginal effects of being a graduate from a disadvantaged social background relative to being in the corresponding advantaged category. Concerning income, the results show that differences between graduates from advantaged and disadvantaged social backgrounds increase over time for all groups, except for Low SES graduates. This process is most pronounced for graduates with a disability and those of Indigenous background. For the former, the gap increases from A\$5,239 in the first year to A\$8,174 in the fifth year and A\$11.733 in the tenth year. Similarly, Indigenous graduates initially earn A\$3,064 more than non-Indigenous graduates, but earn almost A\$3,751 less in the tenth year.

Concerning unemployment benefits, differences are stable over time for most groups. Notable exceptions include Indigenous graduates, where the gap relative to non-Indigenous students grows markedly over time, and NESB graduates, where the gap relative to other graduates declines over the first few years and stabilises.

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Figure 1. Predicted employment income and unemployment benefits, by student social-background characteristics and time since graduation

Notes: Data from customised MADIP dataset (2011-2016). SES: Socio-economic status. NESB: Non English Speaking Background. RRR: Regional, rural or remote. Based on the model results presented in Appendix Table A1. The shaded areas denote 95% confidence intervals.

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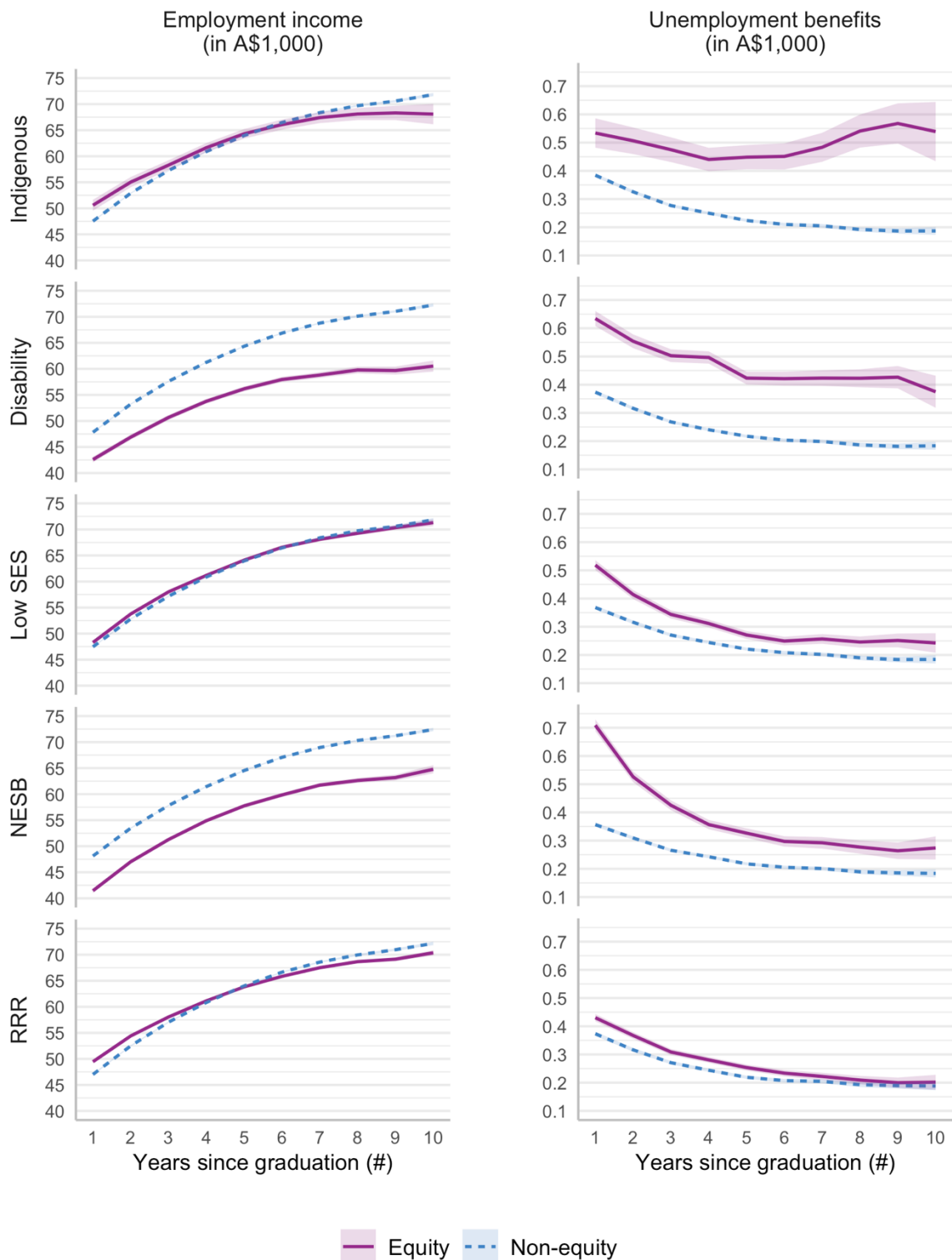
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Figure 2. Marginal effects of student social-background characteristics on employment income and unemployment benefits, by time since graduation
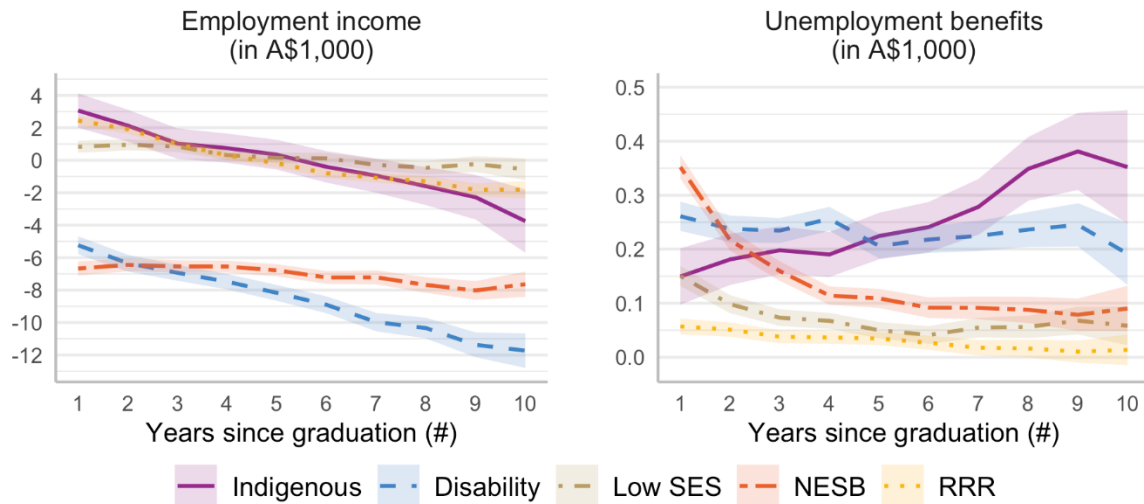
Notes: Data from customised MADIP dataset (2011-2016). SES: Socio-economic status. NESB: Non English Speaking Background. RRR: Regional, rural or remote. Based on the model results presented in Appendix Table A1. The shaded areas denote 95% confidence intervals.

Figure 3. Predicted employment income and unemployment benefits, by student cumulative disadvantage and time since graduation
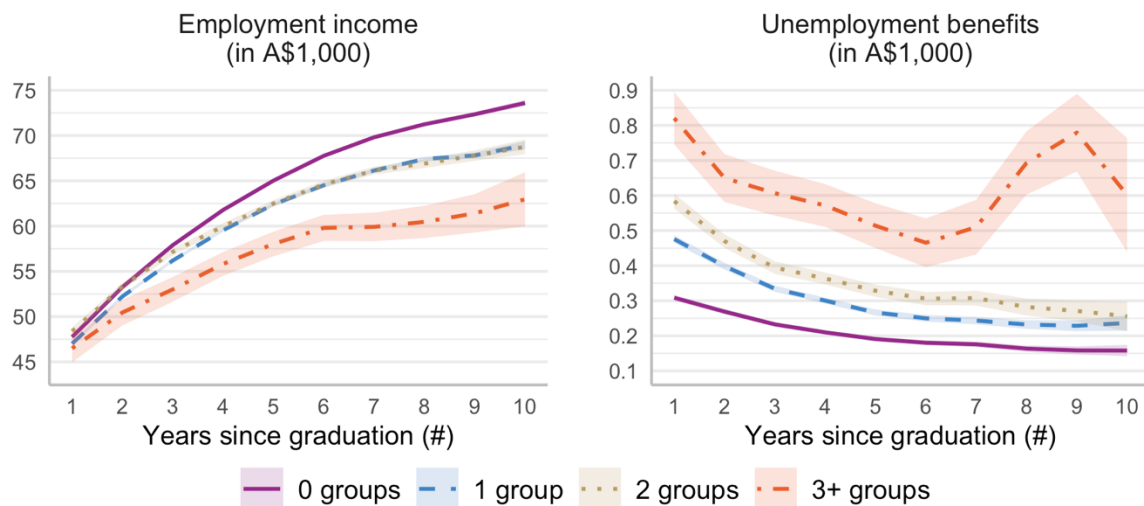
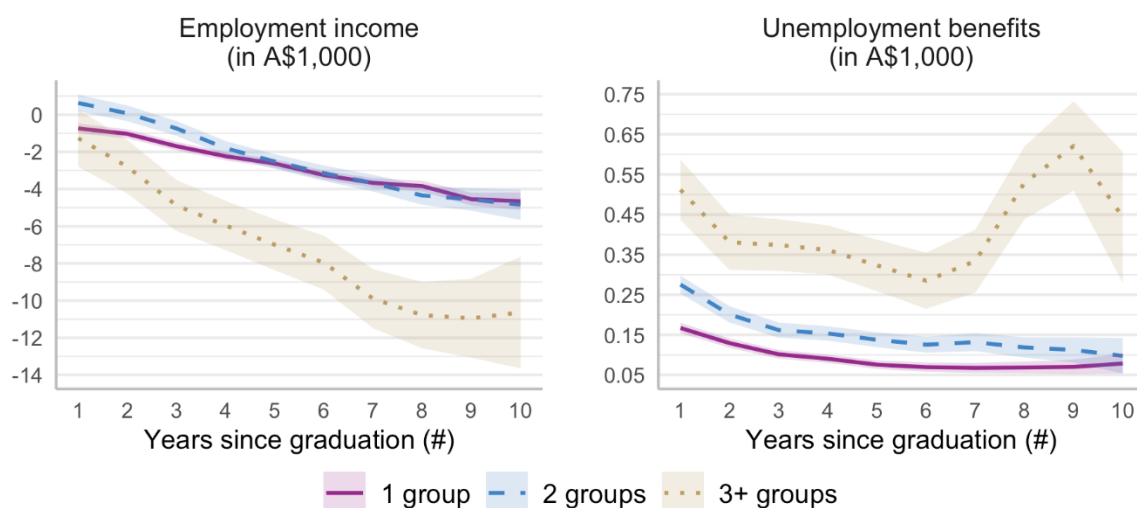*Notes*: Data from customised MADIP dataset (2011-2016). Based on the model results presented in Appendix Table A2. The shaded areas denote 95% confidence intervals.

Figure 3 shows the effects of cumulative disadvantage. The gaps between categories can also be appreciated by inspection of the marginal effects in Figure 4. Both in terms of income and unemployment payments, graduates who do not belong to any disadvantaged group fare best. Their employment income grows at the fastest rate, and their unemployment benefits stay consistently low, resulting in widening gaps between these and other groups of graduates. Overall, the higher the number of disadvantaged groups a graduate belongs to, the lower their income from employment and the higher their unemployment benefits. This pattern of results is particularly pronounced in the case of graduates belonging to three or more disadvantaged groups. These graduates achieve the worst outcomes by far, and gaps between these graduates and other graduates increase over time. The gap in employment income between graduates who do not belong to any disadvantaged group and those who belong to three or more groups grows from A$1,266 in the first year, to A$6,999 in the fifth year, and to A$10,638 in the tenth year. In turn, the gap in unemployment benefits shrinks from A$512 to A$285 during the first six years, to start growing again and reach A$621 in the ninth year, but dropping to A$443 in the tenth year.

Figure 4. Marginal effects of student cumulative disadvantage on employment income and unemployment benefits, by time since graduation

1 group — — 2 groups ⋯⋯ 3+ groups

Notes: Data from customised MADIP dataset (2011-2016). Based on the model results presented in Appendix Table A2. The shaded areas denote 95% confidence intervals.

6. Discussion and conclusion

6.1 Aims and contributions

In this paper, we have leveraged unique and powerful linked administrative data on entire cohorts of Australian graduates to investigate differences in the labour-market trajectories of graduates from advantaged and disadvantaged social backgrounds. In doing so, we make significant contributions to the literatures on social inequality and the returns to higher education. We do so by extending the analysis beyond income inequalities, modelling long-term trends in labour-market outcomes, and simultaneously investigating multiple dimensions of disadvantaged social background (SES, ethnicity, migration, location, and disability). A major feature of the study is the robustness of the evidence provided, owing to the high-quality data at hand. Relying on linked administrative population data allowed us to overcome a number of shortcomings constraining previous studies, such as small sample sizes, cross-sectional designs, and self-reported outcome measures.

6.2 Disparities in labour-market outcomes

Our results reveal increasing returns to tertiary education with time since graduation across all groups of graduates, marked by both increasing earnings and decreasing reliance on income-support payments. This evidence is consistent with the notion of career development and core tenets of human-capital theory, and corroborates findings from previous empirical studies (e.g., Friedman & Laurison, 2019; Jacob et al., 2015; Tomaszewski et al., 2021). The rate of growth is generally highest in the first 3 years post-graduation, and tapers off towards the end of our observation period—at approximately 7 to 10 years since graduation. While some earlier studies had been able to examine growth trajectories (e.g., Tomaszewski et al., 2021), our use of recent population-wide data and objective markers of achievement make our results the most authoritative and up-to-date source of information on the labour-market outcomes of Australian graduates.

Despite the overall growth pattern, our findings also highlight noticeable disparities in outcomes depending on graduates' social backgrounds. Specifically, and consistent with previous studies (e.g., Pitman et al., 2019; Richardson et al., 2016; Tomaszewski et al., 2021), we observe poorer post-graduation outcomes amongst students from disadvantaged social backgrounds relative to their more advantaged counterparts. On the whole, NESB graduates and those with a disability experience the worst outcomes relative to their comparison groups, whereas low-SES graduates achieve the most similar outcomes. As we detail below, the picture for Indigenous and RRR graduates is more complex,

with their relative outcomes changing markedly over the observation period. While these findings are largely consistent with those of previous studies, the scale and richness of our data allowed to better assess outcome disparities for multiple disadvantaged groups, and to do so using a single analytic framework. Furthermore, unlike most previous studies, we were able to provide robust evidence for groups that are typically difficult to capture in sufficient numbers in other data sources—notably, graduates with a disability and Indigenous ascent.

6.3 Diverging pathways of Australian graduates

The key aim of this study was to move beyond the cross-sectional or short-term picture offered by earlier research, leveraging the longitudinal properties of the linked administrative data at hand. Applying growth modelling techniques for panel data, we investigated trends in labour-market disparities between advantaged and disadvantaged graduates for up to 10 years since graduation. This allowed us to ascertain if the gaps are long-lasting or short-lived, and how they evolve as graduates gain experience in the labour market. In this regard, our results provide novel and important evidence that 'gaps' in graduates' labour-market trajectories differ across groups. This underscores the importance of accounting—both theoretically and empirically—for differences in the labour-market experiences of graduates from different socially disadvantaged groups, and the possibility that different barriers and mechanisms are at play for different groups.

Our analyses reveal two core dimensions on which the trajectories differ. The first is the initial magnitude of the disparities. Of the five groups considered, NESB graduates experience the worst outcomes on year after graduation, earning an average of A\$6,668 dollars less on average than their English speaking background (ESB) peers. Graduates with a disability achieve somewhat better outcomes, but still lag behind graduates without a disability. For them, the average gap in earnings one year post-graduation is estimated at A\$5,238. In contrast, Indigenous, RRR and low-SES graduates fare comparatively well. Their earnings one year after graduation exceed those of their more advantaged counterparts by A\$3,063, A\$2445, and A\$831, respectively. The observed pattern of results is consistent with previous research focusing on individual groups, including graduates with a disability (Richardson et al., 2016), NESB graduates (Li et al., 2017) and Indigenous graduates (Pitman et al. (2017).

The second dimension on which the trajectories diverge is the rate at which the disparities fluctuate— i.e., expand or contract—over time, including the possibility of reversals in the dominant group. Alarmingly, we find little evidence that the initial earnings gaps between socially advantaged and

disadvantaged groups close over time. Furthermore, for the three groups that experienced better outcomes in the first years after graduation, we observed a reversal in the dominant group over time, at approximately four to six years after graduation. The disparities in earnings then persist up to the end of our observation period, a full decade after graduation. Even graduates from low SES backgrounds, who fare comparatively well, fail to 'catch up' with their more advantaged counterparts. The diverging group pathways result in a different ordering of groups a decade after graduation, with the earnings disparities between largest for graduates with a disability (A$11,733), followed by NESB (A$7,640), Indigenous (A$3751), RRR (A$1810) and, finally, low SES (A$556) graduates. Taken together, these findings unequivocally emphasise the importance of 'taking the long view' when evaluating the post-graduation outcomes of students from different social groups. Analyses that consider a single time point (e.g., 1 year or 5 years after graduation) fail to provide a wholesome picture of the disparities, and may lead to equivocal policy decisions.

6.4 Additional insights: Income-support reliance and cumulative disadvantage

In addition to the above, the present study makes several other contributions to the stock of knowledge on graduates' labour-market outcomes and how these differ by social background.

First, we not only considered graduates' earnings trajectories, but also their trajectories in unemployment-benefit receipt. Including this outcome enabled us to assess reliance on unemployment benefits amongst graduates, and to shed light on the level of support that might be required from government. As expected, graduates from disadvantaged social backgrounds not only earn less, but also receive greater amounts in unemployment benefits than their counterparts—hinting at more unstable employment patterns. An interesting finding in this regard is that differences in the gaps between advantaged and disadvantaged social groups over time are less diverse in relation to unemployment payments than wages. More specifically, differences between all advantaged and disadvantaged groups persist until the end of the observation period. Interestingly, all groups reduce their reliance on unemployment payments over time, except for Indigenous graduates. This pattern of results serves to highlight the complexity of Indigeneity as a marker of disadvantage in contemporary Australian society. Even those Indigenous individuals who manage to break through the glass ceiling, attaining university degrees and gaining graduate employment, are disproportionately reliant on income support compared to their non-Indigenous peers.

A second, additional contribution of this study was the consideration given to the role of cumulative disadvantage. Due to data constraints, researchers have rarely had the opportunity to investigate how membership in more than one disadvantaged social group affects graduates' labour-market prospects. Our analyses demonstrate that graduates experiencing cumulative disadvantage are significantly worse off than those experiencing 'only' one marker of disadvantage. The negative effect on both earnings and unemployment-benefit receipt of adding one additional disadvantaged social status is substantial, and appears to increase in a linear fashion (at least, for up to 3+ disadvantaged statuses).

6.5 Study limitations and avenues for further research

Despite the importance and robustness of our findings, some study limitations must be acknowledged. These point to potentially fruitful avenues for further inquiry.

First, our data is limited to post-graduation information from university graduates. They do not include detailed information from these individuals before university participation, or any information from comparable individuals who did not engage in tertiary education. Hence, our analyses do not account for selection into higher education. Individuals from a disadvantaged social backgrounds are less likely to commence higher-education studies in the first place (Tomaszewski et al., 2018), and those who access higher education are more likely to drop out (Productivity Commission, 2019). Hence, individuals from disadvantaged social backgrounds who obtain a degree may not be representative of their groups, and the results reported here may not portray the full extent of the labour-market disadvantage experienced by graduates from these groups. In our view, this does not detract from the key message from our study: our findings demonstrate that even these positively selected graduates from disadvantaged social backgrounds have worse labour-market prospects than their peers from advantaged backgrounds. Future studies could address issues of selection by using data that captures both graduates and non-graduates and employing appropriate modelling strategies (e.g., Toutkoushian, Shafiq, & Trivette, 2013).

Second, despite their richness and robustness, the administrative data used in this study lacked measures that would enable us to explore the mechanisms generating disparities in outcomes between graduates from different social backgrounds. For example, some theoretical perspectives focusing on divergences in social and cultural capital indicate that factors such as social networks and cultural fit may be implicated (e.g., Burke et al., 2020; Coleman, 1988; Franzen & Hangartner, 2006; Lin, 1999, 2001). However, these measures are rarely available in administrative datasets. Gaining a better

understanding of the factors driving the observed disparities will necessitate moving away from administrative datasets, relying instead on targeted social surveys or in-depth qualitative analyses of graduates from diverse social backgrounds.

Third, it is important for this study to be replicated using data from other countries. Due to low levels of income inequality and high overall wage returns to university degrees in Australia, differences in labour-market outcomes between advantaged and disadvantaged university graduates in this country may be comparatively low by international standards. Cross-national comparisons can thus help ascertain the moderating role of these and other macro-level institutional factors in shaping differences in the returns to university for graduates form advantaged and disadvantaged social backgrounds.

6.6 Implications for policy and practice

Despite some limitations, our findings carry important lessons for policy and practice. First, our findings highlight the importance of looking beyond graduation when assessing the connections between social background and the higher-education system. Most equity policies in developed countries focus on widening participation or equalising higher-education experiences, whereas comparatively little efforts have been directed at ensuring equal returns to university participation. Our findings demonstrate that inequalities observed at the access and participation stages of the student life cycle extend well beyond university graduation, underscoring the need for urgent policy attention to that phase.

Second, our analyses reveal significant heterogeneity in the extent to which graduates from different disadvantaged groups experience difficulties in the labour market, as measured by employment income. These divergences indicate that focused policy approaches and targeted support that recognise different experiences across groups are preferable over more general, 'broad-brush' approaches. While it remains unclear which specific skills or resources these efforts should tap, the longitudinal patterning in our results can provide important insights into sensitive or critical periods, and how these may differ across groups. Based on our results, NESB graduates and graduates with disabilities seem to experience comparatively greater barriers in the labour market, exhibiting larger and more immediate outcome gaps after graduation. Hence, these groups should be the priority focus of policy efforts to equalise career prospects. The fact that these divergences manifest shortly after graduation suggest that university-led interventions to boost employability and enhance employee-job matches are critical for members of these social groups. On the other hand, the relatively good initial outcomes of low-SES, RRR and Indigenous graduates and subsequent plummeting of the outcomes of the latter two groups point

to a need for long-term outcome monitoring and continued government-led support through labour-market institutions.

Finally, our findings indicate considerable reliance on unemployment benefits across graduates from different socially disadvantaged groups. This highlights the importance of building up employability skills for these graduates as part of their university experience. Universities should consider providing more training and development to boost their graduates' employment prospects, and offer targeted career guidance to students from socially disadvantaged groups. Many such programs already operate in Australian universities supported by the Government's Higher Education Participation and Partnerships Program (HEPPP). Due to the parameters of the funding scheme, these programs have to date predominantly targeted low SES students. Recent higher-education reforms, including the establishment of the Indigenous, Regional and Low-SES Attainment Fund (IRLSAF), offer a unique opportunity for universities to broaden the scope of these initiatives and extend them to other socially disadvantaged groups beyond low SES. Judging from our findings, this is a move in the right direction in eliminating outcome disparities between graduates from advantaged and disadvantaged social groups.

At a broader level, our study serves to showcase the power of leveraging novel data sources (in our case, linked administrative datasets) and deep cross-sectoral partnerships (in our case, Government/Academia) to improve the stock of evidence-based knowledge on the intersections between social background and education.

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Appendix

Table A1. Results from random effects models with disadvantaged social backgrounds, full set of model coefficients

	Income from personal exertion	Unemployment payments
Time since graduation (in years)		
2	4,513.61***	-30.88***
3	7,907.91***	-61.51***
4	11,051.31***	-85.13***
5	13,627.78***	-91.04***
6	15,933.28***	-99.46***
7	17,597.09***	-107.80***
8	18,940.85***	-129.92***
9	20,370.76***	-152.73***
10	21,795.96***	-156.07***
Disadvantaged social backgrounds		
Low SES	831.20***	150.37***
Disability	-5,238.08***	260.98***
NESB	-6,668.32***	352.14***
RRR	2,445.31***	56.89***
Indigenous	3,063.24***	149.47***
Time since graduation × Disadvantaged social backgrounds		
2 × Low SES	124.08	-52.16***
3 × Low SES	12.14	-77.24***
4 × Low SES	-521.54**	-83.11***
5 × Low SES	-681.07***	-100.46***
6 × Low SES	-712.36***	-109.25***
7 × Low SES	-1,114.47***	-95.56***
8 × Low SES	-1,292.83***	-94.36***
9 × Low SES	-1,066.92***	-82.69***
10 × Low SES	-1,386.97***	-92.19***
2 × Disability	-1,103.34***	-23.26
3 × Disability	-1,696.19***	-26.42
4 × Disability	-2,245.24***	-4.78
5 × Disability	-2,935.09***	-55.08***
6 × Disability	-3,670.03***	-42.99**
7 × Disability	-4,735.19***	-36.33*
8 × Disability	-5,102.10***	-24.64
9 × Disability	-6,134.51***	-15.91
10 × Disability	-6,494.73***	-69.51*
2 × NESB	220.35	-135.41***
3 × NESB	126.98	-192.69***
4 × NESB	117.10	-238.06***
5 × NESB	-114.80	-243.28***
6 × NESB	-555.84*	-260.43***
7 × NESB	-546.22*	-260.78***
8 × NESB	-1,015.06***	-264.44***
9 × NESB	-1,354.10***	-273.64***
10 × NESB	-971.47*	-261.97***
2 × RRR	-540.86***	-5.85
3 × RRR	-1,451.37***	-19.02*
4 × RRR	-2,141.60***	-20.27**

5 × RRR	-2,627.66***	-22.44**
6 × RRR	-3,245.75***	-30.28***
7 × RRR	-3,520.81***	-39.41***
8 × RRR	-3,740.98***	-40.75***
9 × RRR	-4,269.20***	-46.61***
10 × RRR	-4,255.66***	-43.36**
2 × Indigenous	-932.82	31.63
3 × Indigenous	-2,036.77***	48.60
4 × Indigenous	-2,317.40***	40.84
5 × Indigenous	-2,721.01***	74.95**
6 × Indigenous	-3,471.09***	91.57**
7 × Indigenous	-4,014.00***	129.04***
8 × Indigenous	-4,659.14***	199.37***
9 × Indigenous	-5,341.67***	231.65***
10 × Indigenous	-6,814.09***	202.60***
Male	8,161.52***	72.74***
Age group		
26-30 years	3,048.31***	13.82***
31-35 years	3,167.00***	61.04***
36-40 years	2,867.90***	190.30***
41-45 years	4,107.13***	361.89***
46-50 years	3,983.69***	433.62***
51+ years	216.13	447.52***
Study area		
Agriculture	-9,485.81***	-15.96
Architecture and Urban Environment	-14,786.19***	74.90***
Building	15,879.21***	-137.50***
Communications	-14,354.82***	237.20***
Dental studies	10,706.94***	-191.51***
Education	-4,936.13***	-36.17***
Engineering and related technologies	16,152.21***	-65.59***
English language	-17,786.19***	243.87***
Environmental studies	-8,078.50***	150.73***
Humanities (inc. history, geography & languages)	-13,367.61***	256.58***
Information technology	567.22*	51.77***
Mathematics	-5,333.38***	97.69**
Medical	52,100.83***	-192.52***
Medical science	-8,981.48***	31.40
Nursing	8,139.55***	-159.45***
Other creative	-24,202.26***	444.43***
Other health	-1,973.37***	-71.48***
Other science	-11,574.14***	124.54***
Political Science	-9,281.44***	229.61***
Psychology	-10,527.76***	138.49***
Society and culture - economics	2,253.91***	28.73
Society and culture - law	6,967.52***	-0.28
Social Work	-4,603.17***	46.63***
Society and culture (other)	-13,473.06***	227.50***
Veterinary science	-5,801.39***	-123.92***
Dual/multiple degrees	246.88	-42.47***
Graduation year		
2006	-8.38	13.45
2007	319.12	3.60
2008	-848.51***	29.60***

	Income from personal exertion	Unemployment payments
2009	-2,204.09***	53.68***
2010	-2,910.35***	75.30***
2011	-3,755.49***	125.66***
State of residence		
Victoria	-4,565.80***	56.13***
Queensland	-1,930.28***	26.94***
South Australia	-5,735.28***	71.51***
Western Australia	2,720.83***	-48.26***
Tasmania	-6,981.88***	122.87***
Northern Territory	7,328.50***	-83.74***
Australian Capital Territory	4,741.85***	-115.39***
Other	-5,750.75***	-281.83**
Receives business income	-15,772.18***	36.15***
Is enrolled in further education	-8,459.99***	78.38***
Constant	52,976.87***	77.39***
Level-2 error variance	10.30***	7.06***
Level-1 error variance	9.99***	7.12***
N (observations)	3,015,028	3,015,028
N (individuals)	563,391	563,391

Notes: Data from customised MADIP dataset (2011-2016). SES: Socio-economic status. NESB: Non English Speaking Background. RRR: Regional, rural or remote. Statistical significance: $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

Table A2. Results from random effects models with cumulative disadvantage, full set of model coefficients

	Income from personal exertion	Unemployment payments
Time since graduation (in years)		
2	4,513.72***	-32.18***
3	7,936.44***	-62.06***
4	11,099.98***	-85.72***
5	13,684.03***	-90.69***
6	16,022.45***	-99.69***
7	17,715.01***	-108.13***
8	19,046.28***	-129.96***
9	20,550.07***	-153.39***
10	22,001.24***	-159.60***
Cumulative disadvantage		
1 group	-737.24***	167.21***
2 groups	629.71**	275.36***
3+ groups	-1,265.20	511.88***
Time since graduation (in years) × Cumulative disadvantage		
2 × 1 group	-295.12*	-37.83***
2 × 2 groups	-559.63**	-74.44***
2 × 3+ groups	-1,536.02*	-131.16**
3 × 1 group	-958.35***	-65.67***
3 × 2 groups	-1,370.22***	-113.51***
3 × 3+ groups	-3,619.41***	-137.90***
4 × 1 group	-1,496.89***	-76.77***
4 × 2 groups	-2,435.42***	-121.78***
4 × 3+ groups	-4,694.12***	-150.24***
5 × 1 group	-1,891.80***	-91.53***

5 × 2 groups	-3,151.34***	-137.64***
5 × 3+ groups	-5,734.02***	-188.68***
6 × 1 group	-2,512.21***	-97.65***
6 × 2 groups	-3,781.19***	-149.71***
6 × 3+ groups	-6,694.36***	-226.83***
7 × 1 group	-2,932.02***	-99.48***
7 × 2 groups	-4,309.22***	-143.64***
7 × 3+ groups	-8,633.29***	-177.86***
8 × 1 group	-3,105.16***	-98.53***
8 × 2 groups	-4,975.04***	-156.72***
8 × 3+ groups	-9,516.98***	17.43
9 × 1 group	-3,808.36***	-97.01***
9 × 2 groups	-5,189.96***	-162.85***
9 × 3+ groups	-9,682.02***	109.08
10 × 1 group	-3,915.85***	-88.64***
10 × 2 groups	-5,471.39***	-177.72***
10 × 3+ groups	-9,373.21***	-68.69
Male	8,163.23***	73.06***
Age group		
26-30 years	3,003.85***	15.47***
31-35 years	3,082.46***	64.02***
36-40 years	2,715.83***	195.53***
41-45 years	3,924.45***	368.08***
46-50 years	3,765.09***	441.01***
51+ years	-77.04	457.69***
Study area		
Agriculture	-8,109.21***	-41.96
Architecture and Urban Environment	-14,667.55***	73.06***
Building	15,990.41***	-137.60***
Communications	-13,983.53***	233.64***
Dental studies	10,077.12***	-181.60***
Education	-4,053.98***	-47.81***
Engineering and related technologies	16,164.48***	-67.30***
English language	-17,720.90***	244.84***
Environmental studies	-7,220.42***	136.76***
Humanities (inc. history, geography & languages)	-13,019.74***	255.08***
Information technology	461.09	53.16***
Mathematics	-5,769.16***	103.72**
Medical	52,130.40***	-193.47***
Medical science	-9,283.83***	35.74
Nursing	8,836.10***	-170.36***
Other creative	-23,802.43***	440.25***
Other health	-1,527.59***	-77.93***
Other science	-11,389.08***	122.43***
Political Science	-9,004.16***	227.22***
Psychology	-10,226.85***	136.27***
Society and culture - economics	2,030.55***	32.15
Society and culture - law	7,029.27***	1.66
Social Work	-4,222.87***	44.25***
Society and culture (other)	-13,144.38***	225.19***
Veterinary science	-5,320.26***	-131.86***
Dual/multiple degrees	126.83	-40.57***
Graduation year		
2006	16.09	13.75

Life
Course
Centre

WORKING
PAPER
SERIES

2007	337.12*	3.37
2008	-865.09***	30.13***
2009	-2,179.63***	53.63***
2010	-2,902.70***	75.69***
2011	-3,730.66***	125.79***
State of residence		
Victoria	-4,406.01***	51.90***
Queensland	-1,531.26***	18.32***
South Australia	-5,585.59***	70.21***
Western Australia	2,872.70***	-50.40***
Tasmania	-5,987.13***	93.85***
Northern Territory	7,810.66***	-95.70***
Australian Capital Territory	4,812.16***	-116.80***
Other	-5,645.25***	-282.90**
Receives business income	-15,756.96***	35.42***
Is enrolled in further education	-8,478.57***	79.51***
Constant	52,606.90***	80.37***
Level-2 error variance	10.31***	7.06***
Level-1 error variance	9.99***	7.12***
N (observations)	3,015,028	3,015,028
N (individuals)	563,391	563,391

Notes: Data from customised MADIP dataset (2011-2016). Statistical significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure A1. Years since graduation for each graduate cohort captured in the data

Years observed